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Suicide attempt predicted by academic performance and childhood IQ: a cohort study of 26000 children

Running title: Academic performance, IQ and suicide attempt

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Abstract

Objective

Academic performance in youth, measured by grade point average (GPA), predicts suicide attempt, but the mechanisms are not known. It has been suggested that general intelligence might underlie the association.

Methods

We followed 26 315 Swedish girls and boys in population-representative cohorts, up to maximum 46 years of age, for a first suicide attempt in hospital records. Associations between GPA at age 16, IQ measured in school at age 13 and suicide attempt were investigated in Cox regressions and mediation analyses.

Results

There was a clear graded association between lower GPA and subsequent suicide attempt. With control for potential confounders, those in the lowest GPA quartile had a near five-fold risk (HR 4.9, 95% CI 3.7-6.7) compared to those in the highest quartile. In a mediation analysis, the association between GPA and suicide attempt was robust while the association between IQ and suicide attempt was fully mediated by GPA.

Conclusions

Poor academic performance in compulsory school, at age 16, was a robust predictor of suicide attempt past young adulthood and seemed to account for the association between lower childhood IQ and suicide attempt.

Significant Outcomes

Academic performance, measured as grade point average (GPA) at age 16, was a robust and strong predictor of suicide attempt up to middle age.
A candidate confounder, childhood IQ, was to a lesser extent predicitve of suicide attempt.

Rather than IQ acting as a confounder for GPA, the association between IQ and suicide attempt was fully mediated by GPA. The results add to the importance of poor academic performance as an indicator of long-term risk.

Limitations

Only severe suicide attempts and self-harm events requiring hospital care were included, since national inpatient registers were used for follow-up data on suicide attempts.
Our data on psychiatric disorders were obtained from the inpatient register and no data were available on less severe psychiatric or psychological problems in childhood and adolescence, which also might hamper academic performance.

Introduction

A history of poor academic performance is more often seen in young adults affected by serious mental health problems than in those not affected. In fact, previous studies demonstrate that the poorer the school grades, the greater the probability of such problems.[1-3] A potential outcome of serious mental illness is suicidal behaviour,[4] which in itself is a cause of much suffering worldwide, leading to 800 000 deaths per year.[5]

Hypothetically, poor grades from school affect young people's future prospects negatively due to a limited access to higher education and employment opportunities and so increases their risk of mental illness.[6] For example, low educational attainment predicted anxiety and depression in a large Norwegian study, and work-related and socioeconomic factors such as job loss and economic hardship were found to partly mediate the associations.[7] On the other hand, people's final grades are reflections of individual abilities and accumulated achievements in school. Children's cognitive abilities, as measured by IQ tests, are important for their academic performance.

Theoretically, IQ and academic performance go hand in hand; IQ tests were invented to predict scholastic ability in children, in order to quickly and accurately determine the educational needs and prospects of each student;[8] and measures of academic performance are often used as a proxy for cognitive ability.[9] Even though cognitive ability is not the only determinant of academic performance, it is indeed an important predictor: in a recent meta-analysis of 240 samples, the population correlation was .54.[10] Previous studies of the association between poor academic performance and later suicidal acts have discussed the possibility that low cognitive ability may be an important explanatory factor.[11, 12] Notably, several studies have found a link between cognitive ability in youth and subsequent suicidal behaviour,[13, 14] so this seems as a likely scenario.

Another possibility is that the association between cognitive ability and suicidal behaviour is mediated by academic performance. That is, cognitive ability predicts academic performance, which in turn is

associated with suicidal behaviour, while IQ has little or no direct effect. A conceptual model for these possible pathways – which are not necessarily mutually exclusive - is shown in Figure 1. Previous studies of academic performance and suicidal behaviour have generally not been able to examine the participants' cognitive abilities, and could not investigate these possible mechanisms.

– Figure 1 about here –

The present study is one of the first to follow girls and boys into adulthood with respect to suicide attempt and take IQ-tests from school and graduation certificates as the point of departure. Andersson et al[15] published a study of IQ-test scores and school grades at age 13 as predictors of suicides among Swedes born in 1948 and 1953, but estimates in the study were uncertain because of a limited number of suicides, especially among the female participants. Furthermore, the importance of IQ in the association between school grades and suicide was never tested, despite the potential link.

Aims of the study

We aimed to investigate the association between performance in compulsory school and suicidal behaviour, measured as hospital admission after attempted suicide, up to middle age, with control for socioeconomic position (SEP) in childhood, psychiatric diagnosis and suicidal behaviour in parents, and being a first or second generation immigrant. Furthermore, we wanted to examine if the association between academic performance and suicide attempt is to some extent accounted for by general cognitive ability, as measured with an IQ-type test; or if academic performance acts as a mediator.

Methods

Study population

The Evaluation Through Follow-up (ETF) study began in the 1960's with the intention to collect data for longitudinal studies on educational and occupational careers. Statistics Sweden, an administrative

agency responsible for official and governmental statistics, collected and stored the data. About 10% of the population was sampled for each cohort, except for the 1977 cohort for which only 5% was sampled. The number of participants and the interval between cohorts, and the information collected, have varied due to practical and financial reasons. More information about the project is found on the ETF website.[16] Here, four birth cohorts with similar information are included, with pupils born in 1967 (n=7807), 1972 (n=7726), 1977 (n=3861) and 1982 (n=6921). The cohort data was linked to the following databases: the National School Register, the National Censuses of 1980, 1985 and 1990 with information on parents' SEP, and the migration database, all kept by Statistics Sweden; and the National Cause of Death Register and the National Inpatient Register, both kept by the National Board of Health and Welfare. We excluded individuals with inpatient data on suicide attempt before graduation, and those who immigrated to Sweden after the 4th school year because academic performance and IQ test performance in newly immigrated students is likely affected by e. g. unfamiliarity with the language.

Academic performance

School grades from the 9th school year, i.e. the final year of compulsory education at approximately age 16, were extracted from the school register held by Statistics Sweden (in case the average school grade was missing, it was extracted from the ETF dataset, if available). The subject grades were based on the students' overall performance and demonstrated knowledge during the semester or course, and in particular performance on subject tests. The school grades from the 9th school year were decisive for admission to upper secondary schools, so incentives to perform well were strong. We calculated the grade point average (GPA) according to previously used procedures [17] and standardized the grade score into a z score (mean=0, SD=1), separately for each cohort. After that, the GPA's were categorized in quartiles. However, individuals who obtained fewer than 8 school subject grades (the limit for high school qualification for most of the cohorts) were excluded since this is mostly due to longstanding illness or other absence.

Cognitive ability/IQ

At the age of 13, a test of cognitive ability was administered to all children by classroom teachers, according to written detailed instructions. The sum of three subtests (verbal ability: antonyms; spatial ability: metal folding; reasoning: number series tests), with a maximum of 120 points, constitutes a measure of global cognitive ability or IQ. The IQ test is described in detail elsewhere [15, 18], and has been tested for reliability against the Swedish conscription test of general cognitive ability with a correlation of .78.[19] We standardized the IQ score into a z score (mean=0, SD=1) separately for each cohort to correct for universal increases in IQ across time (Flynn effect).

Covariates

Information on SEP was obtained from the national censuses when the individuals were at age 8-13. SEP was categorized in seven categories based on the parents' occupation (unskilled manual workers; skilled manual workers; non-manual employees at low and intermediate/high level; farmers; self-employed; and those with no registered occupation). Information on the individual's and parents' immigration was obtained from the migration database. Information on parents' suicidal behavior was recorded as for the children (see below under *Outcome*), with the addition of the National Cause of Death register for completed suicide (available from 1952). Information on parents' psychiatric diagnosis, and the individuals' psychiatric diagnosis prior to graduation from compulsory school and two years thereafter, was obtained from the National Inpatient Register, using ICD codes: 290-315 (ICD-8, 1973-1986); 290-319 (ICD-9, 1987-1996); F00-F99 (ICD-10, 1997 onwards). The National Inpatient Register has a coverage of 86% until 1987 when it rises to 100%. [20]

Outcome: Suicide attempt

Information on severe suicide attempts requiring in-patient care (at least one overnight stay at the hospital) was obtained from the National Inpatient Register. It is administered by the National Board of Health and Welfare. The following ICD-codes were used to identify suicide attempt: 950-59 and 980-89 (ICD-8/9, 1973-1997); X60-84 and Y10-34 (ICD-10, 1997 onwards). Cases with undetermined intention were included, which is standard in register-based epidemiological studies in order not to

exclude true cases.[21] We excluded undetermined cases in sensitivity analyses (see Statistical analyses below).

Statistical analyses

We first used Cox proportional hazards regression to examine the associations of GPA and IQ with suicide attempt, with GPA and IQ categorized based on their *z* score quartiles, using the highest quartiles as the reference groups to facilitate comparison with previous studies. We conducted contrast tests to check the consistent linearity of effects along the levels of IQ scores and GPA, and found that the linearity assumption of effects held. IQ and GPA were first analysed separately, and then included in the same model for mutual control. Next, we examined the association between IQ and suicide attempt mediated by GPA in a mediation analysis, using linear regression and Cox proportional hazards regression, with GPA and IQ modelled as continuous variables based on their *z* score. The asymptotic Sobel test was used for significance of the mediated effect.[22]

Interaction with sex and cohort were investigated by introducing interaction terms in the model (GPA*sex, GPA*cohort, IQ*sex and IQ*cohort, respectively) in order to check whether the cohorts and/or genders were to be analyzed together or separately. There were no evidence of interaction in most analyses and only weak evidence of an interaction of IQ and sex in the mediation analysis (p= .059). In a stratified model, however, the result of this analyses indicated an effect of IQ on suicide attempt in girls. Therefore, an IQ*sex interaction term was included in the model and the results are presented separately for girls and boys in these analyses. We controlled for the effect of sex in all other analyses. The effect of cohort was controlled for by the standardization of IQ and GPA for each cohort, and additional control for cohort had no effect in the analyses. The effect of childhood SEP, being born or having a parent born outside of Sweden, and parents' psychiatric disorder and suicidal behaviour was controlled for in all main analyses. The participants were followed from July 1st after graduation from the 9th grade (at about 16 years of age), up until December 31st 2013 (their age ranging from 31 to 46 years), date of suicide attempt, emigration or death due to any cause, whichever came first. We checked for proportionality over time of the direct and mediated effects of IQ score and

GPA using the scaled Schoenfelds residuals[23] and we detected no violation of the proportionality assumption.

We performed several sensitivity analyses. First, we used multiple imputations (fully conditional specification regressions method) to include individuals with missing IQ scores (N=3319), to see if the results were biased due to their exclusion. Second, we checked for school-level cluster effects in a subset of 17 139 individuals with such data (92.6% of those born in 1972, 1977 and 1982). The clusters were created as pairs of cohort-school, that is, the same school at two distinct cohorts was considered as two different clusters. Third, we repeated the analyses restricting the outcome to suicide attempt with determined intent (ICD codes 950-59 and X60-84) to check for bias due to misclassification. Fourth, the analyses were repeated with a time lag of 5 years between graduation year and start of follow-up to check for a possible effect of reversed causality. Fifth, we excluded the 363 (1.4% of the study sample) individuals with a psychiatric diagnosis in the inpatient register prior to graduation or up to two years after graduation as a second check for reverse causality. Finally, we adjusted for birth month in a subset of 11 517 individuals with such information (98.7 % of those born in 1967 and 1977) to check for any residual confounding due to birth month. All analyses were performed in SAS, version 9.4.

– Table 1 about here –

Results

Of 31 737 individuals in total in the four cohorts, 26 315 (83%) met the inclusion criteria and were eligible for follow-up; they were followed for a minimum of 15 years, and a maximum of 30 years, up to the end of 2013. During this time, 543 (2.1%) of the individuals were for their first time admitted to hospital following a suicide attempt (321 girls/women and 222 boys/men, equivalent to an annual rate of 1.10 and 0.74 per 1000, respectively). Descriptive statistics for the study population are shown in Table 1. At graduation from the 9th school year, disadvantageous background factors were more common with lower GPA's. For example, half of those in the lowest GPA quartile were found in the

lowest IQ quartile as well, while only 3 % of those in the highest GPA quartile had a low IQ. Similar but less sharp gradients were observed also for the background factors.

– Figure 2 about here –

GPA and IQ were both predictive of suicide attempt during follow-up, a dose-response gradient (Figure 2 and web appendix, Table S1). Controlling for the potential confounders in Table 1 had a small attenuating effect on the associations (Table S1) and these variables were kept in the further analyses. The association between GPA and suicide attempt was stronger that the association between IQ and suicide attempt. For example, the risk of suicide attempt was nearly five-fold in the in the lowest compared to the highest GPA quartile (HR 4.9, 95% CI 3.6-6.7), while the risk was two-fold in the lowest compared to the highest IQ quartile (HR 2.3, 95% CI 1.7-3.0). In analyses modelling IQ and GPA quartiles as continuous variables, each quartile decrement in IQ and GPA was associated with HRs for suicide attempt of 1.3 (95% CI 1.12 - 1.4) and 1.8 (95% CI 1.6 - 1.9), respectively (web appendix, table S1). Modelled as SD decrements in IQ and GPA, respectively, the estimates were similar (not shown in table). When GPA and IQ were included in the same model and thereby controlled for each other, the risk associated with lower IQ was attenuated to the null, but the association between GPA and suicide attempt remained unchanged (Figure 2, model 2). That is, IQ did not act as confounder in the association between GPA and suicide attempt. The results were similar whether the control variable (IQ for GPA, and vice versa) was included in the model as a continuous *z* score variable or in quartiles.

In the mediation analysis (Figure 3), the analyses were performed for women and men separately due to a gender-specific effect of IQ on suicide attempt in women in this model. IQ and GPA were modeled in positive terms to facilitate interpretation; that is, their predictive effects were calculated for increasing instead of decreasing IQ and GPA. IQ was positively associated with GPA which in turn was negatively associated with suicide attempt, meaning that higher GPA was associated with a lower

risk. The mediated effect of IQ through GPA was similar in women and men (-.38 and -.37, respectively), and it was substantial in relation to the total effect.

However, the direct and total effects of IQ on suicide attempts differed between boys and women. IQ had no direct effect on suicide attempt in men in the mediation analysis, but for women, there was a weak positive association between IQ and suicide attempt. That is, when the mediated effect of IQ on suicide attempt through GPA was taken into account, a higher IQ was associated with a slightly increased risk of suicide attempt in women. This reflects the weaker total effect of IQ on suicide attempt in women (-.24) compared to men (-.40), resulting in different estimates of the direct effect (.14 and -.03, respectively) when the mediated effect was taken into account.

– Figure 3 about here –

The sensitivity analyses yielded very similar results as the main model. The results of the multiple imputations were consistent with those of the complete-case analyses, meaning that the exclusion of cases with missing values did not beset the estimates (web appendix, Table S2; the following results are available upon request). Similar results were found in analyses controlling for school cluster effects. Restricting the outcome to suicide attempt with determined intent, adding 5 years' time lag after graduation, excluding individuals with a psychiatric diagnosis up to two years after graduation, and adjusting for birth month all yielded similar results.

Discussion

In this follow-up study of more than 26 000 school pupils, the risk of suicide attempt increased markedly with poorer GPA in the final year of compulsory school. The increase was linear across the range of GPA, and the risk was nearly five-fold in the lowest compared to the highest quartile with control for childhood SEP and other background factor. Individual differences in general cognitive ability, measured with an IQ-type test three years before the GPAs were set, did not account for this

association. Instead, the GPA fully mediated the association between IQ and suicide attempt in a mediation analysis.

We found a gradient similar to that which Jablonska et al's[24] showed in their study on academic performance (in GPA) and suicide attempt in 400 000 Swedish residents born 1973 to 1977, followed up to a maximum age of 28. In that study, adjustment for several potential confounders including ethnicity, SEP, maternal education, single-parent household and residency had a limited effect on the results, very similar to the effect of adjustment for the background factors in the present study. Kosidou et al[12] studied associations between GPA and self-reported suicide attempts, and found a slightly weaker association. Most studies on death by suicide have found results in the same direction,[11, 15, 25] although no association was found in women in one register study[17] and a u-shaped association was found between GPA and suicidal behavior (attempted and completed suicide combined) in women in a smaller study on Swedish data.[26] Several of these studies were performed on Swedish populations born in the 1970's or 1980's, overlapping to some extent with the ETF study cohorts.[11, 17, 24] In all studies, any adjustment for social and socioeconomic factors in childhood had little impact on the associations. Several, but not all[27] studies from other countries, including the US,[28, 29] New Zealand[14] and China,[30] have also found associations between academic performance and suicide attempt in youth. However, most of these were cross-sectional[29, 30] or had a follow-up period of about a year,[27, 28] and none followed the students past age 21.

We are aware of only one study controlling for GPA in the association between IQ and suicide. In the sample of Swedes born 1948 and 1953, Andersson et al[15] found, in line with our results, that controlling for GPA attenuated the association between IQ and suicide completely in men (there was no clear association between IQ and suicide in women) but they did not further investigate this finding.

In the present study, the association between GPA and suicide attempt was similar in women and men. However, the association between IQ and suicide attempt differed between genders, but only when the

mediated effect through GPA was controlled for. Taking this mediating effect into account, higher IQ appeared as a risk factor in women. In men, there was no association between IQ and GPA besides the mediated effect. Several,[14, 15, 31-33] but not all[34] studies on men, or women and men analysed together, have found lower IQ to be a robust risk factor for suicidal behaviour. We are aware of only two studies investigating the associations of IQ with suicidal behaviour separately in girls/women. Andersson et al[15] found a weak tendency of a higher risk for completed suicide associated with higher IQ in Swedish women. In the British ALSPAC cohort, a higher IQ was associated with non-suicidal self-harm and suicidal thoughts and plans in adolescent boys, but only with non-suicidal self-harm in girls.[35] Thus, although few, there are some indications of gender differences in the association between IQ and suicidal behaviour in previous studies, but none of these studies included control for academic performance. Of note, however, is that a similar gender difference was found for all-cause mortality in a Swedish cohort followed to age 75, for which mortality was higher in women with higher IQ, when years of completed education was controlled for. In men, a higher IQ was associated with a lower risk even after this adjustment.[36]

Possible explanations

In the literature on life-course predictors of suicidal behavior,[37] and not least in studies of associations between cognitive ability and suicidal behavior,[31, 32] poor problem-solving and verbal ability have been put forward as possible risk factors. However, our results do not support the notion that poor cognitive resources account for the strong association between academic performance and subsequent suicide attempt. On the contrary, the predictive effect of IQ on suicide attempt was fully mediated by academic performance. This points to the importance of academic performance in adolescence as a predictor of long-term mental health.

Adolescence has been described as the second sensitive period in an individual's life, after childhood.[38] During the intense adolescent years, characterized by major changes in social role and lifestyle, education is one essential factor that projects far into adulthood.[38] Thus, a social stratification

occurs whereby higher-performing students have better access to higher education. Education is a well-established social determinant of health, by increased control over one's life as well as a better socio-economic situation.[39] This trajectory might be one link between academic performance in compulsory school and suicide attempt later in life.

Similarly, others have suggested that social and financial circumstances in adulthood might mediate the relationship between academic performance and suicidal behavior, since the obtained school grade is a strong determinant for future educational opportunities and, hence, socioeconomic position.[11, 12, 23] Kosidou et al[12] did control for various self-reported measures of social and financial circumstances in their study, including educational attainment, employment status, financial strain and social support. However, they found no indication that these factors were important in the relationship between school grades and self-reported suicide attempt. Further studies are needed to investigate if this replicates in other samples and with other measures of suicidal behavior and social circumstances.

A different hypothesis is that other types of or personal qualities or individual characteristics, such as impulsivity, conduct disorders and self-esteem, have a role in the association between poor school performance and subsequent suicidal behaviour.[11, 12, 23] That is, such characteristics might lead to poorer school results and, later in life, to a higher risk of attempting suicide. Preceding emotional problems and psychological distress might have a similar role, since such problems can affect performance[6] and continue into adulthood. Previous findings are scarce and ambiguous; adding academic performance in multivariate analyses, including measures of mental health, partly attenuated the association with suicide attempt in one longitudinal study from New Zealand,[14] but not in a cross-sectional study from China,[30] and the distinct effects of these measures on the associations were not investigated. Further research is needed to investigate the role of emotional problems and psychological distress as confounders. Moreover, it is also possible that they act as mediators in the relationship. Along this line, , it has been suggested that the obtained school grades affect self-esteem which, in turn, affects the risk of suicidal behavior,[11, 23] but we had no data to examine this possible pathway.

We found that IQ did not account for any of the association between academic performance and suicide attempt, as had been hypothesized previously.[10, 11] When the mediating effect of academic performance was taken into account, there was even a slight increased risk of suicide attempt associated with a higher IQ at every level of academic performance, but only in women. Thus, the strong association between IQ and academic performance seems to have masked this risk in the models without control for GPA. An association between higher IQ and suicidal behavior has been suggested previously, based on national-level data[40] or certain groups, such as patients with psychoses,[15] which limits generalization. Also, as mentioned above, a higher IQ was associated with non-suicidal self-harm in adolescents in the ALSPAC cohort,[35] but the findings were inconsistent regarding suicidal thoughts, plans and self-harm.[35, 41] In the present study, the association was weak in comparison with the association between GPA and suicide attempt, but encourages further studies to clarify the pathways.

Implications

Cognitive ability is highly correlated with academic performance, but it is not the only determinant - other traits and features such as conscientiousness, self-efficacy and attributional style also contribute.[42-44] It is debated to what extent it is possible to meaningfully increase general cognitive ability and how such an increase would affect health-related outcomes;[45, 46] but given that poor cognitive ability is not a direct risk factor for suicidal behavior, it would not be needed for long-term suicide prevention. Other, more malleable skills that improve academic performance might have indirect but powerful long-term effects. For example, school-based programs aimed to enhance social and emotional abilities have been found to not only increase academic performance, but also to lower emotional distress and promote positive attitudes and pro-social behaviour.[47] However, more research is needed to map the underlying factors of the association between academic performance and suicide attempt, and identify preventive strategies. Moreover, in view of poor academic performance as a risk indicator regardless of any causal relationships between GPA and suicide attempt, our findings are

relevant for high-risk prevention strategies. Since poorly performing pupils have a markedly increased risk of suicide attempt in adulthood, even up to middle age in the present study, interventions targeting this group might have long-term preventive effects.

Strenghts and limitations

The study population consisted of nationally representative samples of young Swedish women and men, with a very high participation rate. A standardized test of cognitive ability was administered in school year 6, three years before the final school grades were set. Linkage to national registers provided reliable information on school grades and severe suicide attempts, with a follow-up up into middle age.

There are also limitations to our study. First, because information on suicide attempt was obtained by hospital records and not by self-reports, attempts that did not require medical care are not accounted for. On the other hand, the use of hospital records gives a valid estimate of severe attempts requiring hospital care, and avoids attrition and response bias. Second, we only had information on psychiatric diagnoses from hospital registers, so we could not control for any possible effects of psychiatric disorders managed in e.g. outpatient or primary care, or not managed at all. Additionally, the National Inpatient Register had an incomplete coverage of psychiatric diagnoses until 1987, so some cases of non-recurring diagnoses were likely missed, including parents' diagnoses. We could only identify 363 individuals with psychiatric disorders up to two years after graduation, implying that information on most cases of psychiatric disorders or psychological distress, which might lead to poor academic performance as well as suicidal behaviour later in life, could not be included in our analyses. Previous studies have found complex and mutual relationships between early academic performance, psychological distress, and later performance.[6] Although data on early psychological distress would be informative, control for psychological distress could partly be an over-adjustment if distress is an effect of poor performance. Third, we had no data on possible early-life risk factors such as birth order, birthweight or birth complications,[37] but these are typically quite weak predictors and are thus unlikely to be important confounders in the association under study. Fourth, excluding individuals

who did not achieve grades in at least 8 subjects, among which subsequent suicide attempt was over-represented, might have led to an under-estimation of the associations under study. However, excluding these individuals might also serve as additional control of confounding by pre-existing psychiatric disorders. Lastly, this study was performed on a sample of rather homogeneous Swedish school children and might not be directly generalized to other populations or settings.

In sum, we found that academic performance was a strong and robust predictor of suicide attempt, even when childhood IQ was controlled for. Additionally, a mediation analysis suggested that academic performance fully mediated the relationship between IQ and suicide attempt. These finding highlights the importance of academic performance for long-term risk, and points to the possibility to influence this risk in the school setting.

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Declaration of interest

The authors declare that they have no competing interests.

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Table 1. Distribution of IQ and background variables over GPA quartiles in cohorts 1967, 1972, 1977 and 1982. N= 26336

		GPA quartiles								
Variables	Total		1st		2nd		3rd		4th	
	n	*%*	n	*%*	n	*%*	n	*%*	n	*%*
Low IQ (lowest quartile)	6600	*25*	3588	*54*	1902	*29*	883	*13*	227	*3*
Low childhood SEP*	6661	*25*	2530	*38*	1869	*29*	1398	*21*	864	*13*
Born outside of Sweden	1140	*4*	358	*5*	334	*5*	236	*4*	212	*3*
Parent born outside of Sweden	4991	*19*	1444	*22*	1299	*20*	1168	*18*	1080	*17*
Parents' psychiatric diagnosis	4937	*19*	1646	*25*	1238	*19*	1145	*17*	908	*14*
Parents' suicidal behaviour	1938	*7*	670	*10*	487	*7*	429	*6*	352	*5*

* Parents in manual occupations (this combined category is shown for illustration; the seven occupational categories described in the Methods are used in the subsequent analyses).

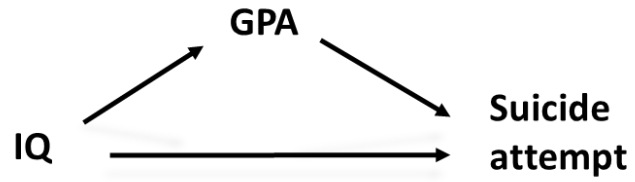

Figure 1. Conceptual model of associations between IQ, academic performance (GPA) and subsequent suicide attempt.

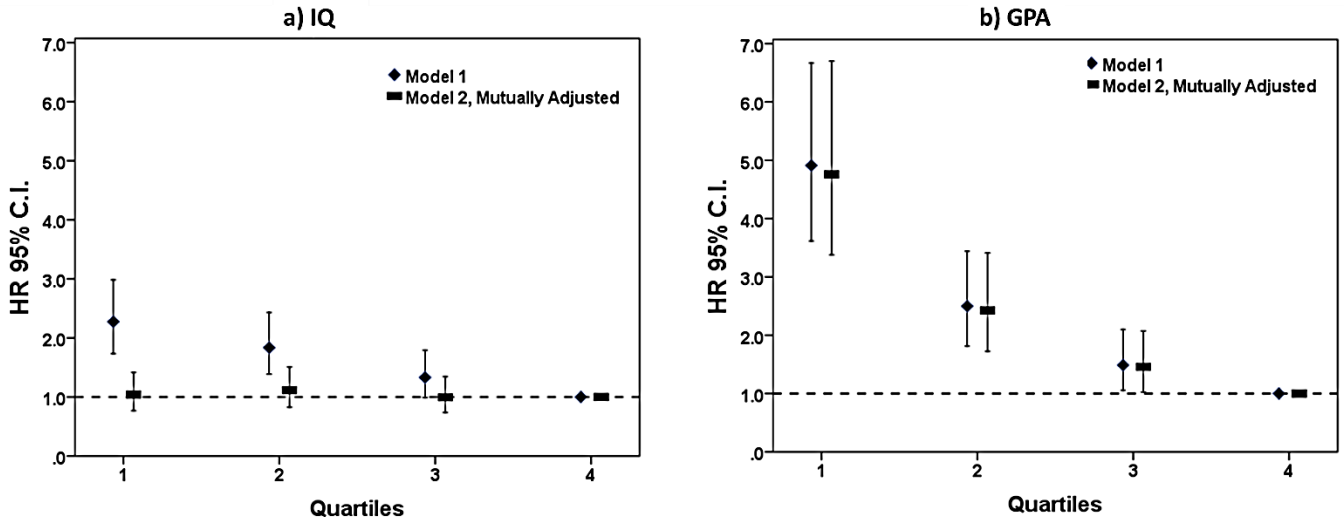

Figure 2. The association of a) IQ and b) GPA with suicide attempt in HRs with 95% CI, in models adjusting for background variables and 1) no mutual control for IQ/GPA, and 2) with mutual control for IQ/GPA.

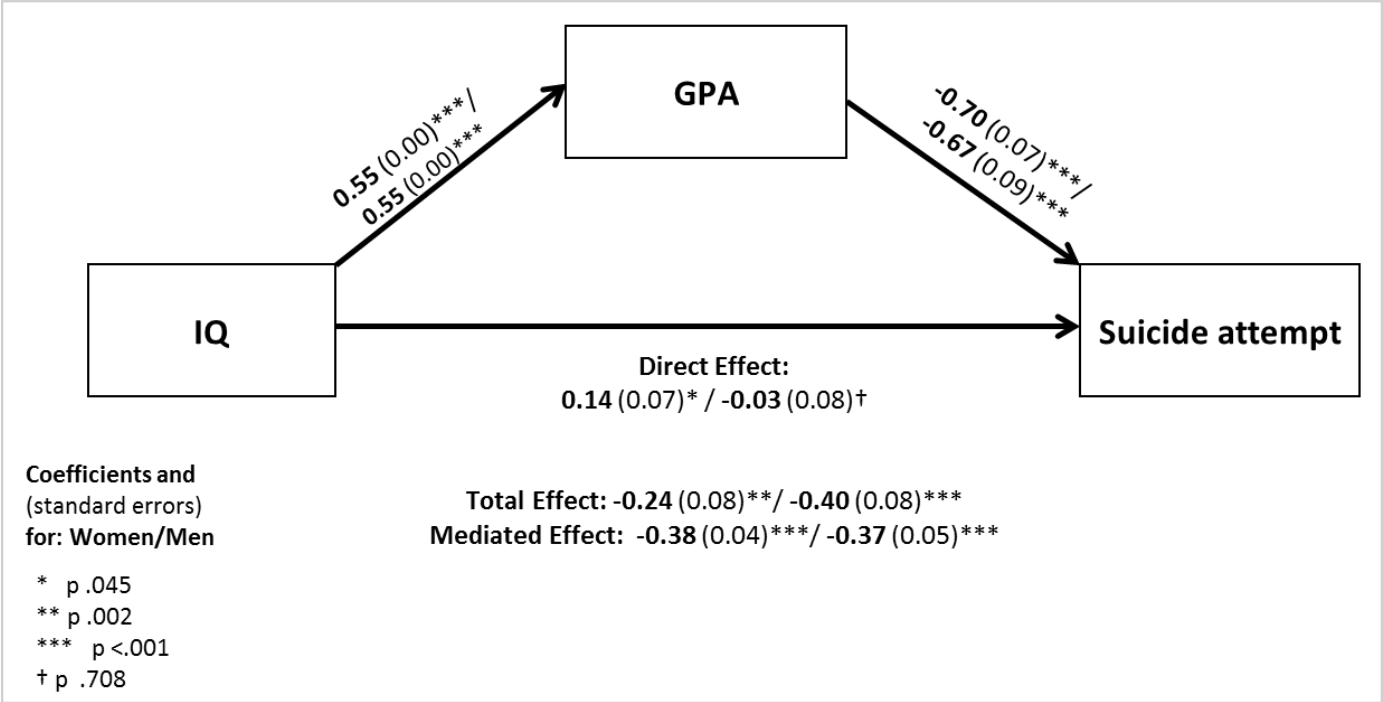

Figure 3. Mediation analysis of associations between IQ, GPA and suicide attempt, in coefficients and (standard errors) for women and men, with adjustment for background factors (childhood SEP, being born outside of Sweden, having a parent/s born outside of Sweden, and parent's psychiatric disorder and suicidal behaviour).